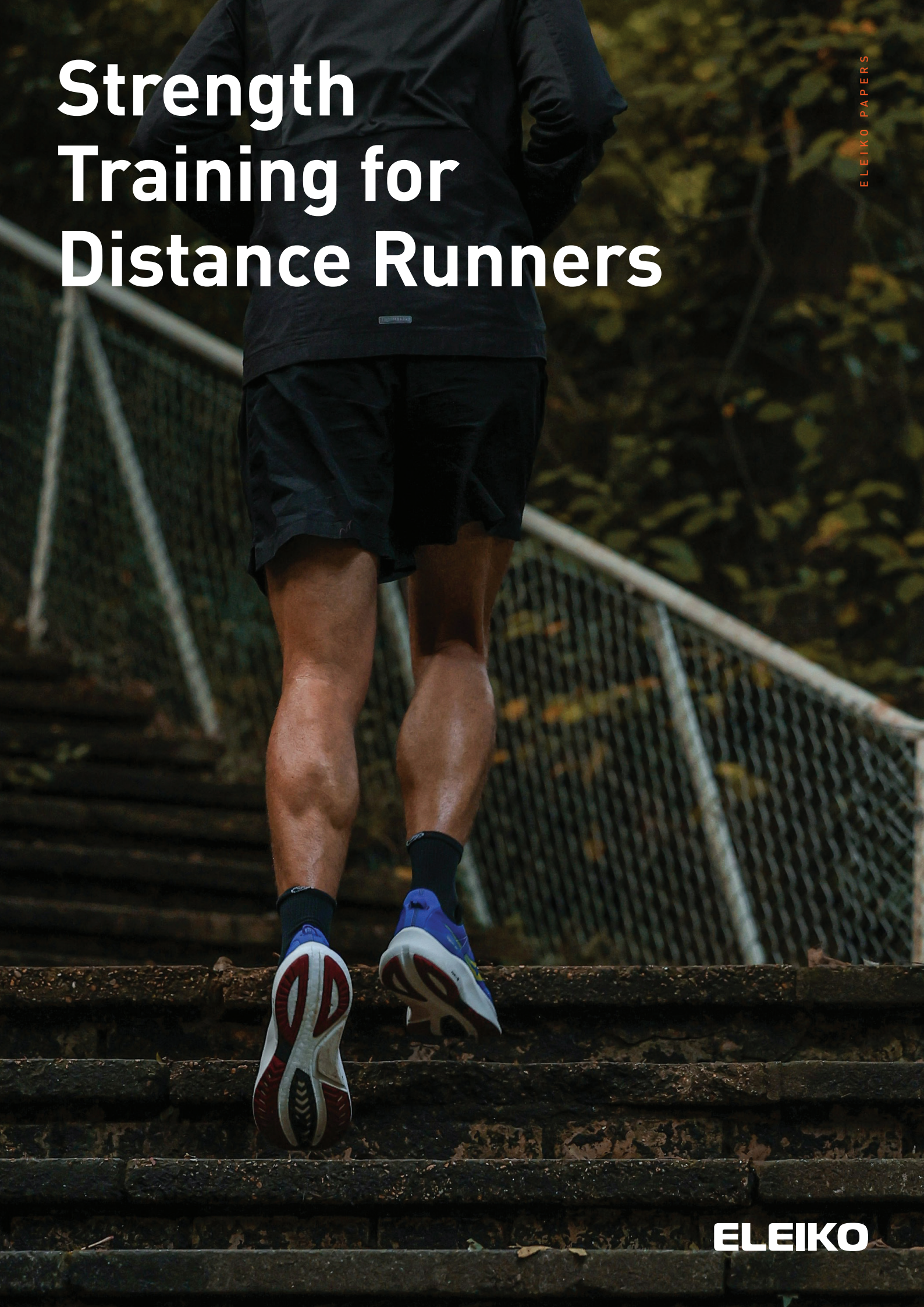
Strength Training for Distance Runners



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Strength & Running

Abstract

Strength training is not usually associated with distance running in the same way that it is with other sports such as football or hockey. When training, distance runners try to maximise their endurance capabilities. Football and hockey players try to maximise strength, speed and power as their sport's biggest plays often stem from an athletic, explosive movement. However, strength training for distance runners is important and is not as dissimilar to that in other sports as you might think. Just because distance running is predicated on endurance does not mean a distance runner will not benefit from training to improve strength and explosiveness. Many races, middle or long distance, come down to the final kick which separates those standing on the podium and those watching others get the medals. Distance runners who do not weight train for strength and explosiveness are limiting their running potential. After reading this paper you will understand how to strength train a distance runner and why lifting heavy loads and performing high velocity movements will maximise their running potential.

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Strength and Distance Running

Train Like You Mean It!

Training for strength and endurance at the same time is commonly referred to as concurrent training (Lewis, 2015). Concurrent high intensity strength training involving heavier loads (typically 75% or greater of one rep maximum) and high velocity movements has been shown to improve performance for distance runners and other endurance athletes (Ronnestad et al., 2012; Storen et al., 2008).

For the body to have any adaptations when exercising, it needs to be pushed or overloaded progressively. Distance runners do this during hard aerobic efforts. Distance runners who train for events ranging from 1500m to a marathon will have specific days within the training week that are hard workout days. The other days may be aerobic runs or cross-training. In order to increase their physiological capacity (VO2Max and lactate threshold) the training must push the runner to an uncomfortable state to trigger the necessary adaptations.

The same can be said for strength training. If an athlete wants to get stronger, they must progressively overload the muscle to prompt muscle growth, strength and neuro-muscular adaptations. When training for sport, heavy load or high intensity movement training is typically done for activities involving speed and power. When strength training for activities not normally associated with power or explosiveness as a necessary component, the training often falls short of adaptations that can transfer to the sport or activity.

Finding the Balance

Distance running is a huge commitment. Whether someone is training for a 5K or a marathon, the miles per week add up. Marathon runners will run seventy-five or more miles per week. College cross country and distance track athletes can run anywhere between fifty to ninety miles per week. Even amateur distance runners who love to run and compete in local races will attain the same or more mileage. A high volume of running can often leave little space or desire for weight training.

When weight training is done, it may fall short of achieving necessary muscular and neuromuscular adaptations to increase performance. Usually this occurs when low weight and low-to-medium volume weight training is done. Conversely, when strength training is programmed improperly with too high a volume, combined with high mileage, it could also lead to overreaching or overtraining, which will decrease performance.

Overreaching occurs when the athlete's body has the same neurological, structural, and hormonal responses to exercise as with normal training, but will be unable to adapt properly without rest (Hoffman, 2012). Performance begins to suffer and some training adaptations may be lost. Typically this can be overcome with a few days of rest. Overtraining syndrome is more serious and results from untreated overreaching that produces long-term impairments in performance and other conditions that may require medical intervention (Coburn et al., 2012).

In any combined strength and conditioning program, a proper balance is necessary to maximise results.

In any combined strength and conditioning program, a proper balance is necessary to maximise results. For a distance runner this can typically be accomplished with two strength training sessions per week during the off season and one session per week in season (Beattie et al.,2017). Two proper strength or high velocity training days in season is certainty possible as well, it just comes down to proper communication between the coach and athlete about the total workload.

Solution

Without question, a distance runner needs a well-developed aerobic system. This is done by running high mileage. As stated earlier, hard workouts are incorporated into the training week for competitive runners to better develop aerobic capacity. Recreational runners should also incorporate workouts which will have a positive effect on performance. However, this should not be the end-all to a distance runner's training. Incorporating properly periodised high-intensity strength training sessions will benefit the runner on many fronts (Karp, 2010):

- **Running economy**
- **Decreased ground contact time**
- **Reactive strength**
- **Muscle-tendon stiffness**
- **Motor unit recruitment**
- **Rate of force development**

Like any strength training program, the athlete should develop an adequate strength base before conducting a strength program involving heavy loads and high velocity movements.

Transfer to Distance Running

Distance runners have the benefit of no external objects or forces involved that are necessary components of the sport (except for a steeple chase competitor of course). Weather and terrain can be a factor, but that is the case for all sports played outdoors. So, if running is the primary component we need to improve, and strength training is a mode used to have a positive impact, what exactly does strength training and high velocity training do to the body to increase running performance?

Musculotendinous stiffness (joint stiffness) is a primary factor on running performance. The joint stiffness optimizes the stretch shortening cycle allowing more elastic energy to be stored during landing creating a more powerful push-off (Brazier et al., 2014). The increased joint stiffness also requires a lower energy expenditure on each stride, thus improving the runner's economy (Lazzer et al., 2014), and has a kinematic impact on the runners ground contact time, stride length and stride frequency (Morin et al., 2006). It doesn't matter whether you are a sprinter or distance runner, adaptations to the muscular and neuromuscular systems will have a positive impact on performance.

A study of twenty competitive distance runners found that forty weeks of strength training (twenty weeks pre-season, twenty weeks in-season), led to significant improvements in maximal and reactive strength, running economy and velocity at maximal oxygen uptake. This was accomplished by the intervention group without any significant body composition variables compared to the control group. The control group showed no significant improvements in maximal or reactive strength, running economy, or velocity at maximal oxygen uptake (Beattie et al., 2017).

A study on competitive middle and long distance runners concluded that a properly implemented concurrent program combining explosive movements and endurance running could be advantageous for these athletes. In this study, the training group showed a significant reduction in 2.4km endurance run time (–3.9%) and 20m sprint time (–2.3%) (Ramirez-Campillo et al., 2014).

Distance runners also rely on low body weight and body mass to minimise their energy expenditure, thus maximising performance during a long race. With that mindset, often it is believed strength training will have a hypertrophic effect on the body which will inevitably result in negative physiological performances. However, another benefit to strength training is the Excess Post-exercise Oxygen Consumption (EPOC) effect. EPOC is the elevated aerobic metabolism following exercise that restores the body to its pre-exercise condition. Highintensity strength training will cause the body to burn more calories, including fat, after exercise than steady-state aerobic exercise. EPOC will vary from person to person based on the volume and intensity of the strength training session. EPOC has the potential to benefit the distance runners' desire for low body weight based on the potential extra caloric expenditure along with adding some lean muscle through proper strength training.

Implementation

The programming of concurrent strength training with endurance running allows for a plethora of options. As long as the strength coach knows the distance running athlete well, programming can be inventive and effective. The following list provides just some of the many examples of strength, high velocity, and sport specific exercises than can be incorporated into a distance runner's training cycle. You will see many of these exercises in strength training sessions of other sports. As stated earlier, strength training a distance runner isn't significantly different than strength training a football or hockey player.The following program is an example of what a distance runner's strength training program may look like. This program would be ideal for a runner who is training in the off season with eight to ten weeks before the competitive season begins. Some of the reps and intensities will vary throughout the six to eight weeks as the athlete progresses through the program. The loads will remain heavy, the reactive and explosive movements should be performed with maximum effort and the isolated or sport-specific movements should be tailored to critical muscles used in the sport to maximize performance and prevent injury. When possible, it is recommended to perform the high intensity strength training session after or at least the same day, as the athletes' hard running workout session. This allows the recovery days to be just that. If hard aerobic workouts and strength training sessions are consistently done on consecutive days, the body is not given enough days off from a hard effort, thus denying the body a sufficient amount of time for complete recovery.

Multi-Joint Strength	High Intensity/Velocity	Sport-Specific/Isolated
Squats (Back, Front, Single-Leg) **Lunges** (In Place, Walk, Reverse) **Dumbbell Step-ups**	**Weighted** – Power Clean, Jerk, Push Press, High Pulls, Jump Squats	Glute/Ham Raise, Fitball Flexion, Hamstring Bridge, Single-Leg RDL
Deadlifts (Barbell, Hex Bar, Sumo, Dumbbell, Kettlebell)	**Bodyweight** – Drop Jumps, Split Jump Squats, Box Jumps, Hurdle Hops (repetitive), Single Leg Line Hops (repetitive), Jump Rope	Band Walks – Linear (forward/back) – 45 degree (forward/back) – Lateral (left/right)
Chest (Flat Bench, Incline, Dumbbells, Fly's, Pushups)	**Forward Movement** – Bounding, Power Skip, Singe/Double Leg Hurdle Hops, Running Jump Rope	Calf Raises (two leg, single leg)
Back (Pullups, Bent-Over Row, Seated Row, Lat Pulls, Cable Single Arm Row)	**Medicine Ball** – Overhead Throws, Underhand Hip Catch/Toss, – Squat Chest Throws, Underhand Power Throws	Towel Curl with Toes, Ankle Mobility, Core Exercises, Foot Dorsi/Plantar Flexion

Day 1

Reactive Strength	Depth Jumps (12"-18")	3 x 4	Drop & immediately jump for height, or do repetitions on multiple same-height boxes
Explosive Strength	Hang Clean	3 x 4	80% 1RM
Max Strength	DB Bench	3 x 6	80% 1RM
Max Strength	Bent Over Row	3 x 6	Movement Skill
Isolated/Sport Specific	Romanian Deadlift	3 x 6	Movement Skill
Isolated/Sport Specific	Band Walks	2 x 10 Each Way	Linear Walk – Forward/Back, Lateral Walk
Core Exercises	Plank & Side Plank (45 sec. each), V-ups (x10) 2 Total Sets		

Day 2

Reactive Strength	Jump Rope	3 x 20-30 sec.	Fast
Explosive Strength	Jump Squats	3 x 5	Movement Skill — Use Kettlebells
Max Strength	Back Squats	3 x 5	80%–85% 1RM
Max Strength	Fitball Flexion	3 x 10	Movement Skill
Isolated/Sport Specific	Band Walks	2 x 10 Each Way	45 Degree Walk — Forward/Back
Isolated/Sport Specific	Medicine Ball	2 x 20	Underhand Hip Toss & Catch w/ Partner
Core Exercises	Medicine Ball Overhead Toss Sit Up w/ Partner (x10), Russian Twist w/ Medicine Ball (x20) — 2 Total Sets		

The ideal repetitions (reps) for strength development may differ between strength coaches, but a safe top end range that most can agree on would be six reps of the athletes one-rep maximum on the multi-joint lifts (bench press, squat, deadlift, bent over row). Some of the auxiliary or sport-specific lifts may be completed with higher reps as these lifts are usually working smaller muscles or the movements can only be safely performed with a light weight. Smaller or auxiliary muscles may need a lower weight in order to properly activate that muscle. A heavier weight may cause the larger surrounding muscles to complete the action.

High velocity movements will also differ in rep ranges depending on the weight, height and movement. For weighted high velocity movements (clean, jerk, push press, high pulls and jump squats) going beyond four to five reps may result in fatigue and poor technique. The goal is to move a substantial weight fast. If the athlete can easily do six or more reps per set then the weight may fall short of achieving adaptations that will transfer to competition.

Some of the low impact bodyweight high velocity movements (repetitive line hops, 6" hurdle hops, jump rope, bounding) can be completed using many more reps. The goal is still to be fast, explosive and focus on limiting ground contact time as the weight is only your body and the impact is relatively close to the ground.

Lastly, some of the more advanced bodyweight high velocity movements (drop jumps, repetitive depth jumps, box jumps, squat jumps) the reps will be lower, closer to six to eight reps at the most. This will vary depending on the height and weight used for each movement.

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Summary

Strength training and high velocity exercises have become an integral part of many athletes' training programmes. In this paper, we have seen the benefits of performing concurrent heavy load or high velocity training to distance running. All athletes want to train efficiently without injury or overtraining, this paper described how a properly periodised strength training program can be incorporated into a distance runner's training regimen for optimal performance. We also looked at how proper heavy load strength and high velocity training for a distance runner can increase performance by increasing joint stiffness, rate of force development and reactive strength while decreasing ground contact time.

We saw how the implementation of a strength training program into the distance runner's training cycle can be tailored to the individual distance runner. Finally, we examined some specific exercises that can be used when strength training a distance runner. You should now feel confident to make the case for distance runners to incorporate strength work into their training.

It is recommended to perform the high intensity strength training session after or at least the same day, as the athletes' hard running workout session.

References

Ache-Dias, J., Pupo, J. D., Dellagrana, R. A., Teixeira, A. S., Mochizuki, L., & Moro, A. R. P. (2017). Effect of Jump Interval Training on Kinematics of the Lower Limbs and Running Economy: Journal of Strength and Conditioning Research, 1. https://doi.org/10.1519/JSC.0000000000002332

Beattie, K., Carson, B. P., Lyons, M., Rossiter, A., & Kenny, I. C. (2017). The Effect of Strength Training on Performance Indicators in Distance Runners: Journal of Strength and Conditioning Research, 31(1), 9–23. https://doi.org/10.1519/JSC.0000000000001464

Brazier, J., Bishop, C., Simons, C., Antrobus, M., Read, P. J., & Turner, A. N. (2014). Lower Extremity Stiffness: Effects on Performance and Injury and Implications for Training. Strength and Conditioning Journal, 36(5), 103–112. https://doi.org/10.1519/SSC.0000000000000094

Coburn, J. W., Malek, M. H., & National Strength & Conditioning Association (U.S.) (Eds.). (2012). NSCA's essentials of personal training (2nd ed). Champaign, IL: Human Kinetics.

Karp, J. R. (2010). Strength Training For Distance Running: A Scientific Perspective: Strength and Conditioning Journal, 32(3), 83–86. https://doi.org/10.1519/SSC.0b013e3181df195b

Lazzer, S., Taboga, P., Salvadego, D., Rejc, E., Simunic, B., Narici, M. V., … di Prampero, P. E. (2014). Factors affecting metabolic cost of transport during a multi-stage running race. Journal of Experimental Biology, 217(5), 787–795. https://doi.org/10.1242/jeb.091645

Lewis, M. (2014). Strength Training and Endurance Athletes. Strength and Conditioning, 2(4), 5–9. National Strength & Conditioning Association (U.S.), & Hoffman, J. (Eds.). (2012). NSCA's guide to program design. Champaign, IL: Human Kinetics.

Ramírez-Campillo, R., Álvarez, C., Henríquez-Olguín, C., Baez, E. B., Martínez, C., Andrade, D. C., & Izquierdo, M. (2014). Effects of Plyometric Training on Endurance and Explosive Strength Performance in Competitive Middle- and Long-Distance Runners: Journal of Strength and Conditioning Research, 28(1), 97–104. https://doi.org/10.1519/JSC.0b013e3182a1f44c

Rønnestad, B. R., Kojedal, Ø., Losnegard, T., Kvamme, B., & Raastad, T. (2012). Effect of heavy strength training on muscle thickness, strength, jump performance, and endurance performance in well-trained Nordic Combined athletes. European Journal of Applied Physiology, 112(6), 2341–2352. https://doi.org/10.1007/s00421-011-2204-9

Spurrs, R. W., Murphy, A. J., & Watsford, M. L. (2003). The effect of plyometric training on distance running performance. European Journal of Applied Physiology, 89(1), 1–7. https://doi.org/10.1007/s00421-002-0741-y

Støren, Ø., Helgerud, J., Støa, E. M., & Hoff, J. (2008). Maximal Strength Training Improves Running Economy in Distance Runners: Medicine & Science in Sports & Exercise, 40(6), 1087–1092. https://doi.org/10.1249/MSS.0b013e318168da2f

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